Enhancing the Sustainability of Environmentally Friendly Whitefly Control

Authors: David Crowder, Timothy Dennehy, Yves Carriere, Bruce Tabashnik

Affiliation: Department of Entomology, University of Arizona, Tucson, AZ, 85721

Introduction

Sweetpotato Whitefly

- One of the world's most serious crop pests
- Losses in U.S. estimated at $157 million per year
- Chemical control required in agricultural areas

Management Crisis in Arizona in the mid-1990's

- Extreme yield losses due to evolution of resistance to synthetic insecticides
- Farmers spraying 5-7 times/ year in cotton (Fig. 1)

New Strategies Implemented in 1996

- Focus on integrated pest management
- Use of biorational insecticides (Pyriproxyfen and buprofezin, Once / yr only)
- Reduced insecticide usage for 10 years (Fig. 1)

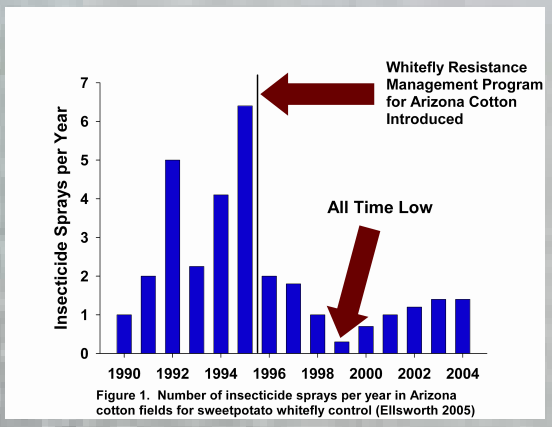

Figure 1. Number of insecticide sprays per year in Arizona cotton fields for sweetpotato whitefly control (Ellsworth 2005)

Pyriproxyfen

- Insect growth regulator, kills eggs and pupae
- "Environmentally friendly" insecticide
- Has aided in reducing insecticide use, preserved beneficial insects, and increased farmer profits
- No field failures over last 10 years
- Concerns about sustainability of pyriproxyfen:
  - Whiteflies in Israel have developed resistance
  - Signs of reduced susceptibility in Arizona

Objectives

- Combine simulation models with experiments to study factors affecting the evolution of resistance to pyriproxyfen
- Determine the most effective management for the sweetpotato whitefly using pyriproxyfen

Some Simulation Modeling Results

- Resistance evolution was affected by:
  1) Pyriproxyfen Concentration
  2) Differences between males and females
  3) Dominance of Resistance

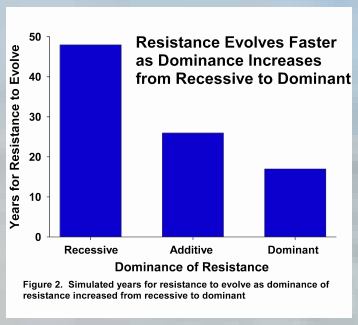

Figure 2. Simulated years for resistance to evolve as dominance of resistance increased from recessive to dominant

Some Laboratory Results

- No differences in male or female susceptibility to pyriproxyfen when treated as eggs
- Resistant males had higher mortality to pyriproxyfen than resistant females when treated as pupae
- Concentration affected dominance of resistance

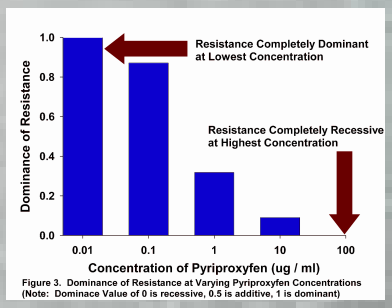

Figure 3. Dominance of Resistance at Varying Pyriproxyfen Concentrations (Note: Dominace Value of 0 is recessive, 0.5 is additive, 1 is dominant)

Conclusions

- Pyriproxyfen will be more effective in the long term if resistance is recessive
- Concentration affects dominance of resistance in the lab
- Concentration may be a critical factor affecting the evolution of resistance in the field

Future Work

- Field experiments to compare to lab results
- Simulation models incorporating new data

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